

U.S. Patent and Trademark Office
 Randolph Building
 401 Dulany Street
 Customer Service Window
 Mail Stop PCT
 Alexandria, VA 22314

ATTORNEY DOCKET NO. 502972-PCT-US-D

CLIENT REF. NO. 03-2285D-US

U.S. APPLICATION NO. 60/516,148

**TRANSMITTAL LETTER TO THE UNITED STATES
 DESIGNATED/ELECTED OFFICE (DO/EO/US)
 CONCERNING A FILING UNDER 35 USC 371 AND 37 CFR 1.491**

INTERNATIONAL APPLICATION NO.
 PCT/US2004/35651

INTERNATIONAL FILING DATE
 October 27, 2004

PRIORITY DATE CLAIMED
 October 31, 2003

TITLE OF INVENTION METHOD AND APPARATUS FOR CONTROLLING EXHAUST GAS RECIRCULATION AND START OF COMBUSTION IN RECIPROCATING COMPRESSION IGNITION ENGINES WITH AN IGNITION SYSTEM WITH IONIZATION MEASUREMENT

APPLICANT(S) FOR DO/EO/US Ed VanDyne and Mark R. Woolston

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
3. ☐ This is an express request to begin national examination procedures (35 USC 371(f)).
4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 USC 371(c)(2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 USC 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 USC 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).
11. Nucleotide and/or Amino Acid Sequence Submission
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM or CD-R (2 copies); or
 - ii. ☐ Paper Copy
 - c. ☐ Statement verifying identity of above copies

Items 12 to 19 below concern other document(s) or information included:

12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 - ☐ Form PTO-1449
 - ☐ Copies of References (except for U.S. patents and applications)
13. ☐ An assignment for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
14. ☒ A FIRST preliminary amendment.
 - ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☒ Application Data Sheet Under 37 CFR 1.76
18. ☒ Return Receipt Postcard
19. ☐ Other items or information:

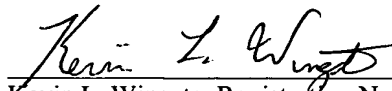
U.S. APPLICATION NO. 60/516,148		INTERNATIONAL APPLICATION NO. PCT/US2004/35651		ATTORNEY DOCKET NO. 502972-PCT-US-D		CLIENT REF. NO. 03-2285D-US	
20. The following fees are submitted:						CALCULATIONS	PTO USE ONLY
<input checked="" type="checkbox"/> National Stage Filing Fee						\$300.00	
Search Fee						\$100.00	
<input checked="" type="checkbox"/> USPTO was ISA				\$100.00			
<input type="checkbox"/> Search report provided to USPTO by other entity				\$400.00			
<input type="checkbox"/> All other situations				\$500.00			
Examination Fee						\$100.00	
<input checked="" type="checkbox"/> US was IPEA and all claims satisfy PCT Article 33(1)-(4)				\$100.00			
<input type="checkbox"/> All other situations				\$200.00			
ENTER APPROPRIATE BASIC FEE AMOUNT=						\$500.00	
<input type="checkbox"/> Claim Fee							
CLAIMS		NUMBER FILED		NUMBER EXTRA		RATE	
Total Claims		18 -20=		0		x \$ 50.00	
Independent Claims		4 - 3 =		1		x \$200.00	
<input type="checkbox"/> Multiple Dependent Claim(s) (if applicable)						+\$360.00	\$
<input type="checkbox"/> Application Size Fee (\$250 for each additional 50 sheets over 100)						\$	
<input type="checkbox"/> Surcharge of \$130.00 for furnishing the National fee or oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.						\$	
TOTAL OF ABOVE CALCULATIONS=						\$700.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.						\$()	
SUBTOTAL=						\$700.00	
<input type="checkbox"/> Processing fee of \$130.00 for furnishing English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.						\$	
TOTAL NATIONAL FEE=						\$700.00	
<input type="checkbox"/> Fee for recording the enclosed assignment. The assignment must be accompanied by an appropriate cover sheet. \$40.00 per property.						+	\$
TOTAL FEE=						\$700.00	
						Amount to be: refunded	\$
						charged:	\$

- a. ☐ No fee is believed to be due.
- b. ☒ Please charge Deposit Account No. 50-3505 the total fee indicated above.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-3505. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO CUSTOMER NO.
53609:

53609


 Kevin L. Wingate, Registration No. 38662
 Reinhart Boerner Van Deuren P.C.
 483 North Mulford Road, Suite 7
 Rockford, Illinois 61104
 (815) 484-1900 (telephone)
 (815) 484-1032 (facsimile)
 Date: April 21, 2006

CERTIFICATION UNDER 37 CFR 1.10

"Express Mail" Label Number: EV 746146258 US

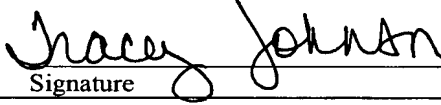
Date of Deposit:

April 21, 2006

I hereby certify that this transmittal document with respect to the U.S. national phase of the above-referenced International Patent Application, including all of the items listed thereon as enclosures, is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Tracey Johnson

Printed Name of Person Signing:


Signature

U.S. Patent and Trademark Office
Randolph Building
401 Dulany Street
Customer Service Window
Mail Stop PCT
Alexandria, VA 22314

COPY
ATTORNEY DOCKET NO. 502572 PCT-US-0

CLIENT REF. NO. 03-2285D-US

U.S. APPLICATION NO. 60/516,148

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 USC 371 AND 37 CFR 1.491**

INTERNATIONAL APPLICATION NO.
PCT/US2004/35651

INTERNATIONAL FILING DATE
October 27, 2004

PRIORITY DATE CLAIMED
October 31, 2003

TITLE OF INVENTION METHOD AND APPARATUS FOR CONTROLLING EXHAUST GAS RECIRCULATION AND START OF COMBUSTION IN RECIPROCATING COMPRESSION IGNITION ENGINES WITH AN IGNITION SYSTEM WITH IONIZATION MEASUREMENT

APPLICANT(S) FOR DO/EO/US Ed VanDyne and Mark R. Woolston

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
3. ☐ This is an express request to begin national examination procedures (35 USC 371(f)).
4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 USC 371(c)(2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 USC 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 USC 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).
11. Nucleotide and/or Amino Acid Sequence Submission
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM or CD-R (2 copies); or
 - ii. ☐ Paper Copy
 - c. ☐ Statement verifying identity of above copies

Items 12 to 19 below concern other document(s) or information included:

12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 - ☐ Form PTO-1449
 - ☐ Copies of References (except for U.S. patents and applications)
13. ☐ An assignment for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
14. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☒ Application Data Sheet Under 37 CFR 1.76
18. ☒ Return Receipt Postcard
19. ☐ Other items or information:

U.S. APPLICATION NO. 60/516,148		INTERNATIONAL APPLICATION NO. PCT/US2004/35651		ATTORNEY DOCKET NO. 502972-PCT-US-D		CLIENT REF. NO. 03-2285D-US	
20. The following fees are submitted:						CALCULATIONS	PTO USE ONLY
<input checked="" type="checkbox"/> National Stage Filing Fee						\$300.00	
Search Fee						\$100.00	
<input checked="" type="checkbox"/> USPTO was ISA				\$100.00			
<input type="checkbox"/> Search report provided to USPTO by other entity				\$400.00			
<input type="checkbox"/> All other situations				\$500.00			
Examination Fee						\$100.00	
<input checked="" type="checkbox"/> US was IPEA and all claims satisfy PCT Article 33(1)-(4)				\$100.00			
<input type="checkbox"/> All other situations				\$200.00			
ENTER APPROPRIATE BASIC FEE AMOUNT=						\$500.00	
<input type="checkbox"/> Claim Fee							
CLAIMS		NUMBER FILED		NUMBER EXTRA		RATE	
Total Claims		18 -20=		0		x \$ 50.00 \$	
Independent Claims		4 - 3 =		1		x \$200.00 \$200.00	
<input type="checkbox"/> Multiple Dependent Claim(s) (if applicable)						+\$360.00	\$
<input type="checkbox"/> Application Size Fee (\$250 for each additional 50 sheets over 100)							\$
<input type="checkbox"/> Surcharge of \$130.00 for furnishing the National fee or oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.							\$
TOTAL OF ABOVE CALCULATIONS=						\$700.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.							\$()
SUBTOTAL=						\$700.00	
<input type="checkbox"/> Processing fee of \$130.00 for furnishing English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.							\$
TOTAL NATIONAL FEE=						\$700.00	
<input type="checkbox"/> Fee for recording the enclosed assignment. The assignment must be accompanied by an appropriate cover sheet. \$40.00 per property.						+	\$
TOTAL FEE=						\$700.00	
						Amount to be:	
						refunded	\$
						charged:	\$
<p>a. <input type="checkbox"/> No fee is believed to be due.</p> <p>b. <input checked="" type="checkbox"/> Please charge Deposit Account No. 50-3505 the total fee indicated above.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-3505. A duplicate copy of this sheet is enclosed.</p> <p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <p>SEND ALL CORRESPONDENCE TO CUSTOMER NO. 53609:</p> <p style="text-align: center; margin-top: 20px;">53609</p> </div> <div style="width: 45%; text-align: right;"> <p>Kevin L. Wingate, Registration No. 38662 Reinhart Boerner Van Deuren P.C. 483 North Mulford Road, Suite 7 Rockford, Illinois 61104 (815) 484-1900 (telephone) (815) 484-1032 (facsimile) Date: April 21, 2006</p> </div> </div>							

CERTIFICATION UNDER 37 CFR 1.10

"Express Mail" Label Number: EV 746146258 US

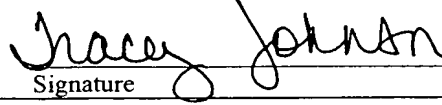
Date of Deposit:

April 21, 2006

I hereby certify that this transmittal document with respect to the U.S. national phase of the above-referenced International Patent Application, including all of the items listed thereon as enclosures, is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Tracey Johnson

Printed Name of Person Signing:


Signature

Application Data Sheet

APPLICATION INFORMATION

Application Type:: Regular
Subject Matter:: Utility
Suggested classification::
Suggested Group Art Unit::
CD-ROM or CD-R?:: None
Number of CD Disks:
Number of Copies of CDs::
Sequence Submission?::
Computer Readable Form (CRF)?:: No
Number of Copies of CRF::
Title:: METHOD AND APPARATUS FOR CONTROLLING
EXHAUST GAS RECIRCULATION AND START OF
COMBUSTION IN RECIPROCATING COMPRESSION
IGNITION ENGINES WITH AN IGNITION SYSTEM WITH
IONIZATION MEASUREMENT
Attorney Docket Number:: 502972-PCT-US-D
Request for Early Publication?:: No
Request for Non-Publication?:: No
Suggested Drawing Figure::
Total Drawing Sheets::
Small Entity?:: No
Latin Name::
Variety denomination name::
Petition Included?:: No
Petition Type::
Licensed US Govt. Agency::
Contract or Grant Numbers::
Secrecy Order in Parent Appl.?:: No

APPLICANT INFORMATION

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Ed
Middle Name::
Family Name:: VanDyne
Name Suffix::
City of Residence:: Loveland
State or Prov. of Residence:: CO
Country of Residence:: US
Street of mailing address:: 2604 Farisita Drive

City of mailing address:: Loveland
State or Province of mailing address:: CO
Country of mailing address:: US
Postal or Zip Code of mailing address:: 80538
Inventor Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Mark
Middle Name:: R.
Family Name:: Woolston
Name Suffix::
City of Residence:: Bolton
State or Prov. of Residence:: MA
Country of Residence:: US
Street of mailing address:: 651 Main Street

City of mailing address:: Bolton
State or Province of mailing address:: MA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 01740

CORRESPONDENCE INFORMATION

Correspondence Customer Number:: 53609
Phone:: (815) 484-1900
Fax:: (815) 484-1032
E-mail Address:: rockmail@reinhardtllaw.com

REPRESENTATIVE INFORMATION

Representative Customer Number:: 53609

DOMESTIC PRIORITY INFORMATION

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This Application	National Stage of	PCT/US2004/35651	October 27, 2004
This Application	An application	60/516,148	October 31, 2003
	claiming the benefit		
	under 35 U.S.C.		
	119(e)		

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Ed VanDyne, et al.

Art Unit: Not Yet Assigned

Application No.: Not Yet Assigned

Examiner: Not Yet Assigned

Filed: April 21, 2006

For: METHOD AND APPARATUS FOR CONTROLLING
EXHAUST GAS RECIRCULATION AND START OF
COMBUSTION IN RECIPROCATING COMPRESSION
IGNITION ENGINES WITH AN IGNITION SYSTEM WITH
IONIZATION MEASUREMENT

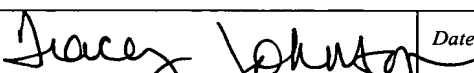
PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Prior to the examination of the above-identified application, please consider the following remarks.

Amendments to the claims are reflected in the claim listing which begins on page 2.
Remarks begin on page 5.

<i>CERTIFICATE OF MAILING OR TRANSMISSION UNDER 37 CFR 1.8</i>			
I hereby certify that this Preliminary Amendment and all accompanying documents are, on the date indicated below, <input checked="" type="checkbox"/> being deposited with the United States Postal Service as "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 to: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.			
Name (Print/Type)	Tracey Johnson		
Signature		Date	April 21, 2006

CLAIM LISTING

1-41. (Cancelled)

42. (Original) A method of preventing misfires in a diesel engine having at least one spark plug comprising the step of providing at least one spark to the at least one spark plug when combustion of the diesel fuel mixture has not begun on time.

43. (Original) The method of claim 42 wherein each of the at least one spark plug is located in a cylinder of the diesel engine and wherein the step of providing at least one spark to the at least one spark plug when combustion of the diesel fuel mixture has not begun on time comprises the step of providing at least one spark to the at least one spark plug if combustion has not been sensed prior to a specified crank angle for that cylinder.

44. (Original) The method of claim 42 wherein the step of providing at least one spark to the at least one spark plug when combustion of the diesel fuel mixture has not begun on time comprises providing at least one high energy spark after a target crank shaft angle of the rise of ion current has passed corresponding to the latest desired start of combustion.

45. (Original) The method of claim 42 further comprising the step of measuring the ion current with a negative polarity of ionization on the electrode of an ion sensor.

46. (Original) A method of controlling the start of injection in a direct injection reciprocating compression ignition engine using a spark plug type ion sensor comprising the steps of:

comparing the measured crank shaft angle of the rise of ion current to a target crank shaft angle of the rise of ion current corresponding to a desired start of combustion; and

adjusting the injection timing such that the crank shaft angle of the rise of ion current is within a tolerance window of the target crank shaft angle.

47. (Original) The method of claim 46 further comprising the steps of:
retarding a start of injection angle to move an early angle of the rise of ion current towards the given target for the next cycle; and

advancing the start of injection angle to move a late angle of the rise of ion current towards the given target for the next cycle.

48. (Original) The method of claim 46 further comprising the step of using an average of at least two prior cycles to determine an average of the rise of ion current.

49. (Original) The method of claim 46 further comprising the step of measuring the ion current with a negative polarity of ionization on the electrode of an ion sensor.

50. (Original) A method for determining the crank shaft angle at the rise of the ion current signal using a spark plug type of ion current sensor in a combustion chamber of a reciprocating compression ignition engine comprising the steps of:

determining when the ion current signal rises; and
determining the engine crank shaft angle when the ion current signal rises.

51. (Original) The method of claim 50 wherein the step of determining the crank shaft angle at the rise of the ion current comprises the steps of:
receiving an ion current signal from the spark plug type of ion current sensor;
determining a change in ion current level before combustion corresponding to a start of the chemical activity of combustion; and
determining the crank shaft angle at the angle where the ion current signal starts to rise.

52. (Original) The method of claim 51 wherein the step of receiving the ion current signal from the one of the spark plug type ion sensors comes through an ignition coil.

53. (Original) The method of claim 50 further comprising the step of measuring the ion current with a negative polarity of ionization on the electrode of the spark plug type of ion current sensor.

54-67. (Cancelled)

68. (Original) A method for controlling the start of combustion of a dual mode reciprocating engine having a combustion chamber in which combustion is normally

spark ignited comprising the step of controlling the level of exhaust gas recirculation (EGR) admitted into the combustion chamber based upon ionization current feedback after sparks are turned off.

69. (Original) The method of claim 68 wherein the method of controlling the start of combustion further comprises the steps of:

comparing the measured crank shaft angle of the rise of ion current to a target crank shaft angle of the rise of ion current corresponding to a desired start of combustion; and

adjusting the level of EGR admitted into the combustion chamber such that the crank shaft angle of the rise of ion current is within a tolerance window of the target crank shaft angle.

70. (Original) The method of claim 69 further comprising the step of adjusting a temperature of the EGR admitted into the combustion chamber to an optimum temperature for combustion.

71. (Original) The method of claim 69 wherein the step adjusting the level of EGR admitted into the combustion chamber comprises the steps of:

decreasing the level of EGR admitted into the combustion chamber to move an early angle of the rise of ion current towards the given target for the next cycle; and

increasing the level of EGR admitted into the combustion chamber to move a late angle of the rise of ion current towards the given target for the next cycle.

72. (Original) The method of claim 69 wherein the step of comparing the measured crank shaft angle of the rise of ion current uses an average of at least two prior cycles to determine the average of the rise of ion current.

73. (Original) The method of claim 68 further comprising the step of measuring the ionization current with a negative polarity of ionization on the electrode of an ion sensor.

74-87. (Cancelled)

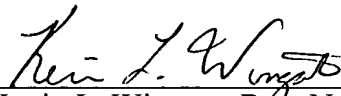
In re Appln. Of: Ed VanDyne et al.
Application No.: Not Yet Assigned

REMARKS

The applicants kindly request that the claim amendments indicated in the Claim Listing be entered prior to examination of the application. No claims have been amended. Claims 1-41, 54-67, and 74-87 have been cancelled. No new claims have been added. Upon entry of the preliminary amendment, claims 42-53 and 68-73 remain pending in the application.

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



Kevin L. Wingate, Reg. No. 38662
Reinhart Boerner Van Deuren P.C.
483 North Mulford Road, Suite 7
Rockford, Illinois 61107
(815) 484-1900 (telephone)
(815) 484-1032 (facsimile)

Date: April 21, 2006